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Shipman

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(54) **FLEXIBLE DRY SPRINKLER**

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This patent is subject to a terminal disclaimer.

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(51) **Int. Cl.**

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A62C 37/14	(2006.01)
A62C 3/00	(2006.01)
A62C 37/48	(2006.01)

(52) **U.S. Cl.**

CPC ***A62C 35/62*** (2013.01); ***A62C 3/004*** (2013.01); ***A62C 35/645*** (2013.01); ***A62C 35/68*** (2013.01); ***A62C 37/11*** (2013.01); ***A62C 37/14*** (2013.01); *A62C 37/48* (2013.01)

(58) **Field of Classification Search**

CPC A62C 31/02; A62C 35/62; A62C 37/11; A62C 37/12; A62C 37/14; A62C 37/16

USPC ..... 169/16, 17, 37–41, 56–59, DIG. 3

See application file for complete search history.

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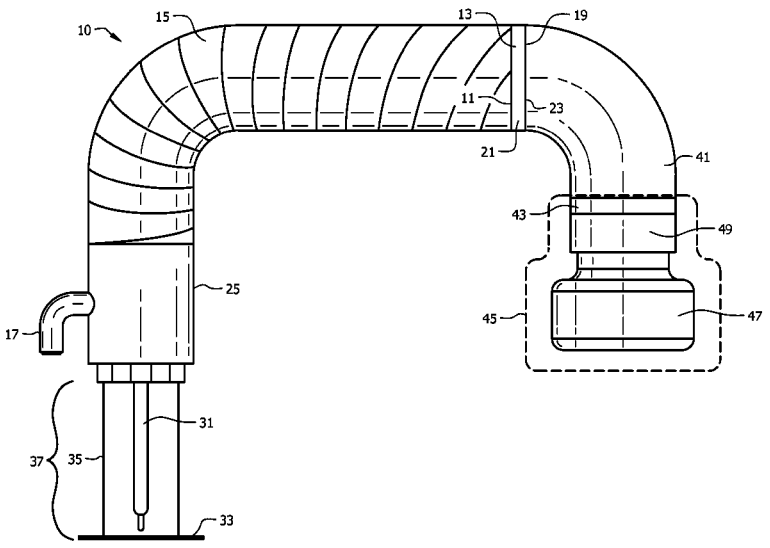
(57) **ABSTRACT**

An X-brace configuration locks a valve element in a latched position until a fusible element breaks releasing pressurized inert gas. Upon depressurization, the X-brace configuration releases the valve element to open and allow water flow through the flexible sprinkler assembly.

20 Claims, 6 Drawing Sheets



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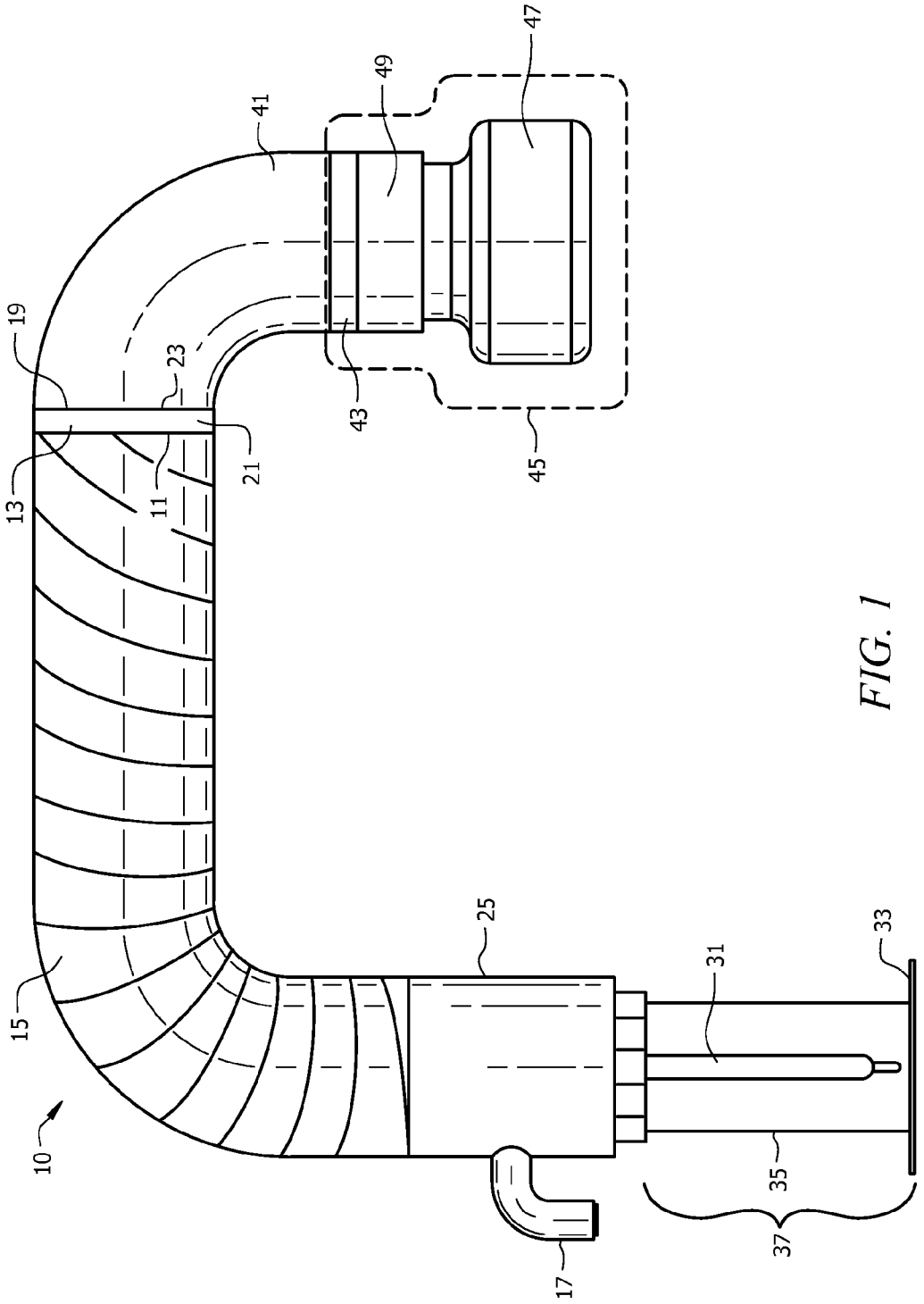

FIG. 1

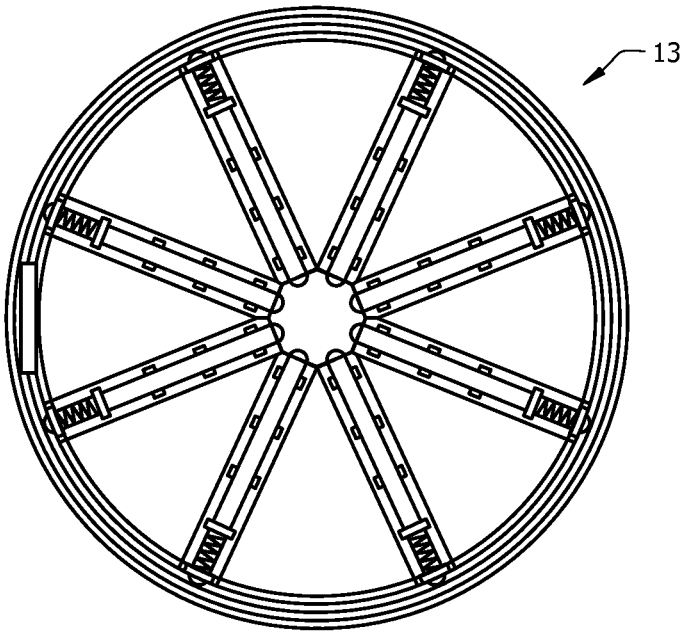

FIG. 2

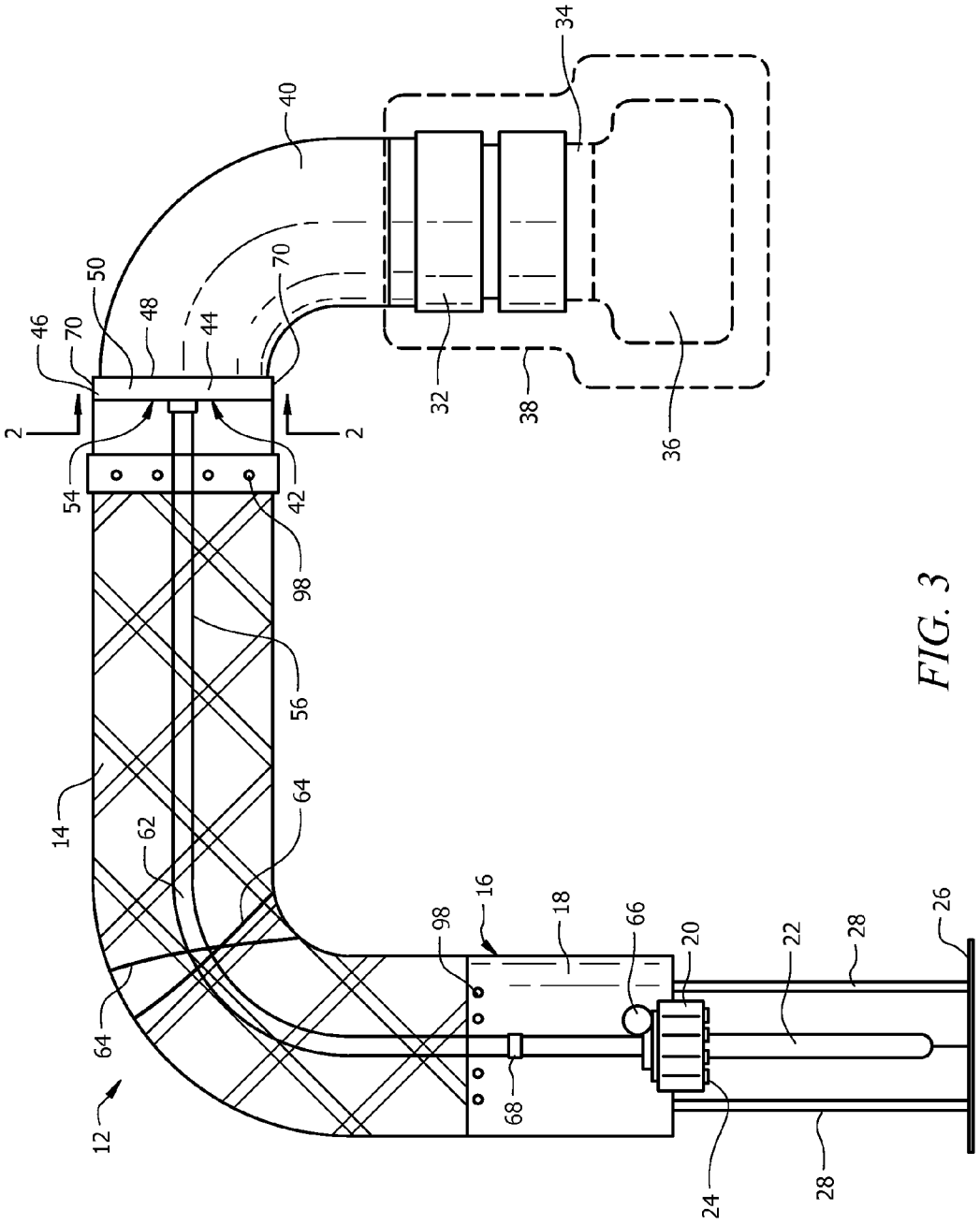
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FIG. 3

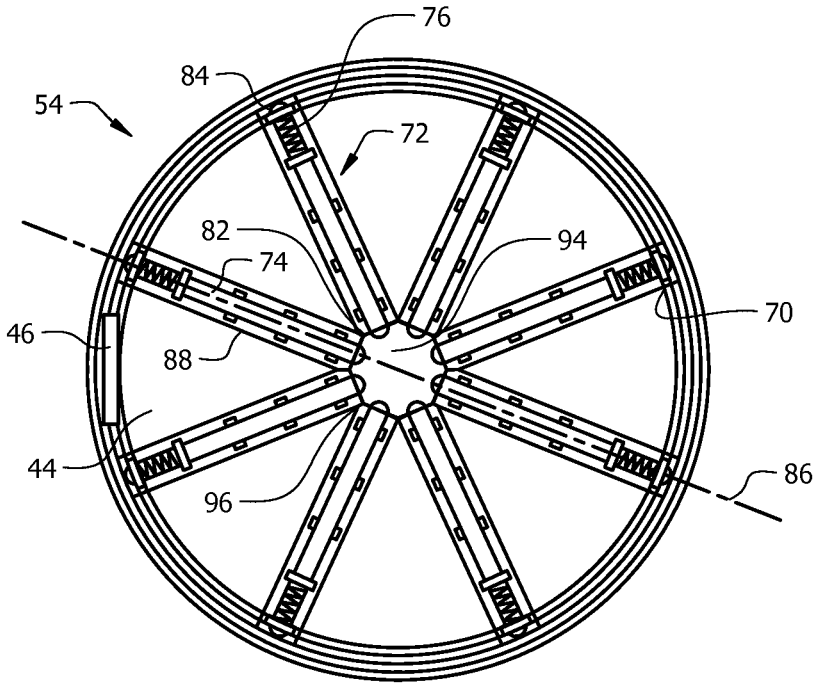

FIG. 4

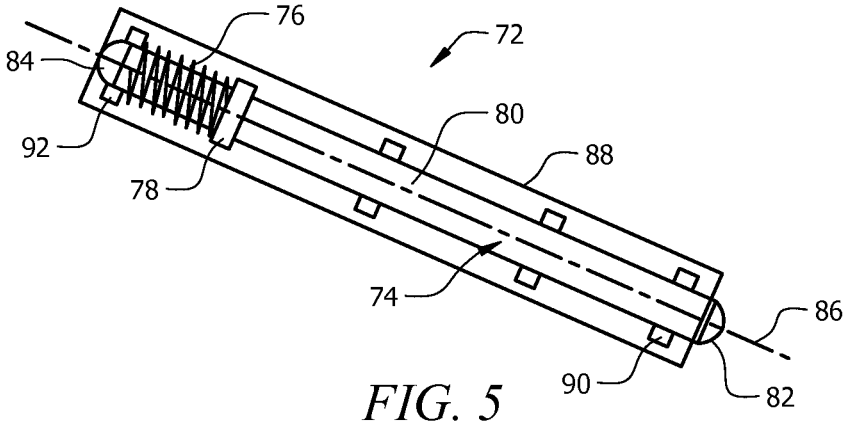

FIG. 5

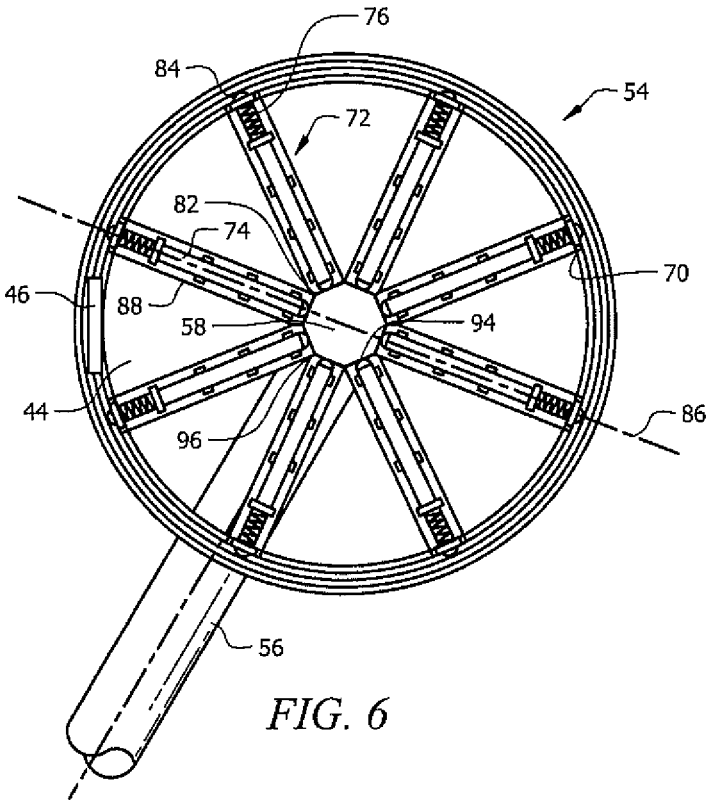
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FIG. 6

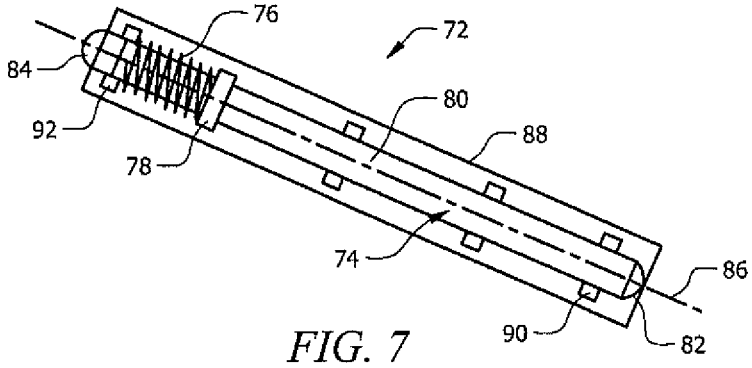
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FIG. 7

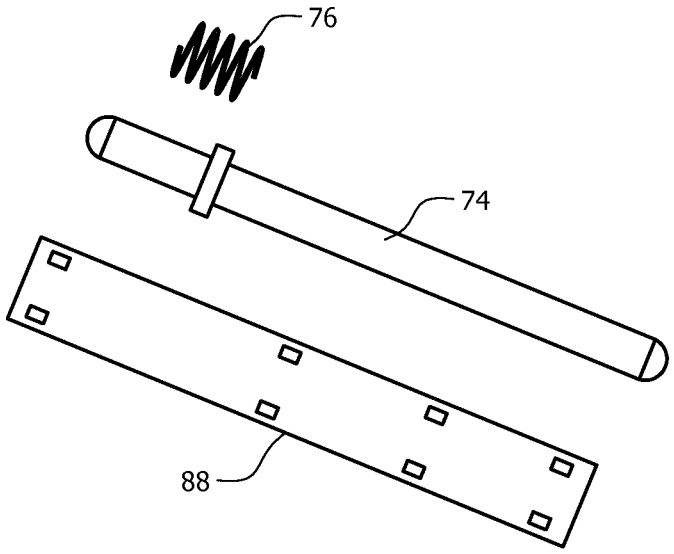

FIG. 8

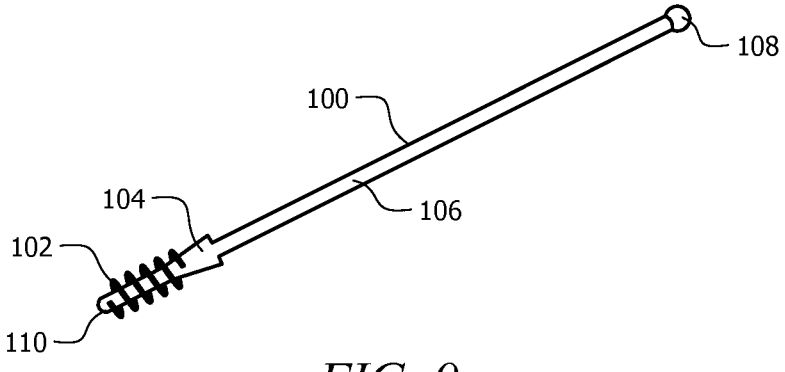

FIG. 9

FLEXIBLE DRY SPRINKLER

CROSS REFERENCE TO RELATED APPLICATIONS

The present application claims the benefit under 35 U.S.C. §119(e) of U.S. Provisional Patent Application Ser. No. 61/619,899 filed Apr. 3, 2012 and entitled "X-Brace Valve and Flexible Connection for Fire Sprinklers," and U.S. Provisional Patent Application Ser. No. 61/490,737 filed May 27, 2011 and entitled "Flexible or Straight Dry Pendent Fire Sprinkler Hose with Xbrace," each of which is incorporated herein by reference for all purposes.

TECHNICAL FIELD

The present disclosure relates generally to fire sprinkler systems, and in particular, to an X-brace valve and flexible dry sprinkler assembly.

BACKGROUND

Prior art conventional dry barrel sprinklers for use in commercial fire sprinkler systems are sold to fire system installers in fixed lengths. The installer has to first install branch line piping for a sprinkler system and then measure a suitable length for dry barrel fire sprinklers for installation. An installer will order fire sprinklers for the installation according to the lengths measured. Delivery typically takes seven to ten business days, which delays installation and completion of construction projects. Longer delays occur if mistakes are made in measuring and the fire sprinklers have to be reordered in a different length.

Dry fire sprinkler systems often deteriorate rapidly due to condensation being trapped in such systems. With rigid dry sprinkler systems, an increased number of fittings is often required to route rigid piping from a branch line to a desired fire sprinkler assembly location. This increase in the number of fittings results in providing additional places where condensation may collect without being able to drain. Additionally, dry fire sprinkler systems can be filled with air or inert gas, which is expelled during operation of such systems. The response time for expelling air or inert gas from the system and providing water to a fire zone is critical for containing a fire. With additional piping and fittings required for routing dry fire sprinkler systems, the volume required for evacuation and filling with water is increased.

SUMMARY

Embodiments of the present disclosure generally provide a flexible dry sprinkler assembly system.

An X-brace valve and flexible connection for fire sprinklers are disclosed. The X-brace is included in a flexible fire sprinkler assembly, but may also be used in rigid sprinkler installations. The flexible fire sprinkler assembly is a pendent dry fire sprinkler assembly, which has a flexible body structure, constructed of corrugated or braided hose similar to that commonly used for plumbing household clothes washing machines. A sprinkler nozzle can be secured to a first end of the conduit, which is provided by a flexible hose. The sprinkler nozzle has a first fitting, a sprinkler orifice and fusible element. The fusible element is provided by a fluid filled glass bulb, which will break when ambient temperatures reach a predetermined temperature. A second fitting is secured to a second end of the flexible conduit, and a valve is mounted to the second fitting. The valve includes a valve element, which is pivotally mounted to the second fitting and moveable from a latched position to an unlatched position. Breaking of the fusible element releases any inert gas inside the conduit. Upon depressurization, the X-brace configuration releases the valve element to open and allow water flow through the flexible sprinkler assembly.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present disclosure and its features, reference is now made to the following description, taken in conjunction with the accompanying drawings, in which:

FIG. **1** is a side elevation view and partial cut-away view of a dry flexible fire sprinkler assembly made according to one embodiment of the present disclosure;

FIG. **2** is a sectional view of the flexible fire sprinkler assembly of FIG. **1**, taken along section **2-2** of FIG. **1**, and shows a frontal elevation view of an X-brace valve latch in a latched position, according to one embodiment of the present disclosure;

FIG. **3** is a side elevation view and partial cut-away view of a dry flexible fire sprinkler assembly made according to a second embodiment of the present disclosure;

FIG. **4** is a sectional view of the flexible fire sprinkler assembly of FIG. **3**, taken along section line **2-2** of FIG. **3**, and shows a frontal elevation view of an X-brace valve latch in an unlatched position, according to one embodiment of the present disclosure;

FIG. **5** is a side elevation view of a slider lock of the X-brace valve latch of FIG. **4**, and shows the slider lock in a released position, according to one embodiment of the present disclosure;

FIG. **6** is a sectional view of the flexible fire sprinkler assembly of FIG. **3**, taken along section line **2-2** of FIG. **3**, and shows a frontal elevation view of the X-brace valve latch in a latched position, according to one embodiment of the present disclosure;

FIG. **7** is a side elevation view of the slider lock of the X-brace valve latch of FIG. **6**, and shows the slider lock in a locked position, according to one embodiment of the present disclosure;

FIG. **8** is an exploded view of the slider lock of FIG. **7** according to one embodiment of the present disclosure; and

FIG. **9** is a side elevation view of a lock pin according to another embodiment of the present disclosure.

DETAILED DESCRIPTION

The present disclosure generally provides an X-brace valve and a flexible hose connection for fire sprinklers.

FIG. **1** illustrates a dry flexible fire assembly system **10** according to one embodiment of the present disclosure. It should be understood that system **10** shown in FIG. **1** is for illustrative purposes only and that any other suitable system or subsystem could be used in conjunction with or in lieu of system **10** according to one embodiment of the present disclosure.

In an embodiment, system **10** may comprise a valve **11** with an X-brace latch **13**, a conduit **15** and an insert pipe **17**.

In an embodiment, the valve **11** is a swing check valve, such as a clapper valve, and includes a swing-type valve element **19**, such as a clapper, for angularly moving to engage a seal **21** against a seal seat **23**. An X-brace valve latch **13** may be used to secure the valve element **19** in a latched position until the system is exposed to a predetermined temperature.

In an embodiment, the conduit **15** may be flexible and formed with an outer cover of braided metal. A sprinkler nozzle **25** may be mounted to a first end of the conduit **15** and a connector fitting **43** is mounted to a second end of the conduit **15**. The sprinkler nozzle **25** may include a fitting **27**, a sprinkler orifice **29** and a fusible element **31**, such as a fluid filled glass bulb, as is conventionally used in other sprinkler assemblies.

Valve **11** is provided between the connector fitting **43** and the conduit **15**. The connector fitting **43** is secured to the second end of the conduit **15** with an elbow fitting therebetween. The connector fitting **43** connects or otherwise couples the system **10** to a pipe T **45** in a sprinkler branch line **47**. A connector coupling **49** secures the connector fitting **43** to the pipe T **45**.

System **10** may further comprise an insert pipe **17**. In an embodiment the insert pipe **17** may be connected to or otherwise coupled to system **10** through the conduit **15** or a sprinkler nozzle **25**. In other embodiments, the insert pipe **17** may be integrally formed with system **10**.

System **10** may also include a diffuser **33**, or spray plate, and support arms **35**.

In one embodiment, air, nitrogen, other suitable inert gases, or a combination thereof may be introduced into system **10** through the insert pipe **17** to inflate and pressurize the conduit **15**. The pressure created by the introduction of a suitable gas would cause pressure to be exerted on the valve **11**, which would hold closed the X-brace valve latch **13** and the valve element **19**.

The valve **11**, which engages the pressurized gas, may have an interior surface area larger than the seal seat **23**, which engages the pressurized water. In such embodiments, a surface differential method (utilizing pressure X surface area=force) is employed to operate the system **10**. The seal seat **23**, having less interior surface area, requires increased force of fluid pressure to open.

In operation, when the system **10** is exposed to a predetermined temperature, the fusible element **31** will break and expel the pressurized inert gas, thereby unlatching X-brace valve latch **13** and valve element **19** and allowing the pressurized water to flow from system **10**.

In operation, air, nitrogen, other suitable inert gases, or a combination thereof may be introduced into system **10** prior to installation or after installation through insert pipe **17** or by other suitable method. Additionally, air, nitrogen, other suitable inert gases, or a combination thereof may be reintroduced into system **10** through insert pipe **17** as desired to achieve the desired pressure.

In alternative embodiments, antifreeze solution, other suitable liquids, or a combination thereof may be introduced into system **10** through insert pipe **17**.

In alternative embodiments, the X-brace valve latch and/or the valve element **19** of the present disclosure may also be used in wet sprinkler installations and in rigid sprinkler assemblies. For rigid sprinkler assemblies, the conduit **15** may be replaced with a rigid tubular member, such as a pipe or tubing.

In operation, employing the mechanics of system **10** in rigid sprinkler assemblies may allow a less expensive manufacturing option.

In an embodiment, sprinkler nozzle **25**, fusible element **31**, diffuser **33** and support arms **35** (the "sprinkler head **37**") may be replaceable without having to replace other elements of system **10**. After the pressurized inert gas is released, the sprinkler head **37** may be replaced. The system **10** may then be re-pressurized to the desired pressure by introducing air, nitrogen, other inert gases, or a combination thereof through insert pipe **17**.

In other embodiments, the sprinkler head **37** may be replaced without having to release the pressurized gas from system **10**.

FIG. **2** is a sectional view of the flexible sprinkler assembly **12** of FIG. **1**, taken along the section line **2-2** of FIG. **1**, and shows a frontal elevation view of an X-brace type valve latch **13** in an unlatched position.

FIG. **3** illustrates a dry flexible fire assembly system **12** according to one embodiment of the present disclosure. It should be understood that the system **12** shown in FIG. **3** is for illustrative purposes only and that any other suitable system or subsystem could be used in conjunction with or in lieu of system **12** according to one embodiment of the present disclosure.

In one embodiment, system **12** could generally be similar to system **10** shown in and described in conjunction with FIGS. **1-2** above (with like parts having similar numbers).

In an embodiment, system **12** may comprise a valve **42** with an X-brace latch **54**, and a flexible conduit **14**.

Flexible conduit **14** may be formed with an outer cover of braided metal. In an embodiment, a sprinkler nozzle **16** is mounted to a first end of the flexible conduit **14** and a connector fitting **32** is mounted to a second end of the conduit **14**. The sprinkler nozzle **16** may include a fitting **18**, a sprinkler orifice **20** and a fusible element **22**, such as a fluid filled glass bulb, as is conventionally used in other sprinkler assemblies. In an embodiment, the fusible element **22** breaks when exposed to a predetermined temperature.

The connector fitting **32** is secured to the second end of the flexible conduit **14** with an elbow fitting **40** therebetween. The connector fitting **32** connects or otherwise couples the sprinkler assembly **12** to a pipe T **34** in a sprinkler branch line **36**. A connector coupling **38** secures the fitting **32** to the pipe T **34**.

Valve **42** is provided between the connector fitting and the flexible conduit **14**. In an embodiment, the valve **42** is a swing check valve, such as a clapper valve, and includes a swing-type valve element **44**, such as a clapper, mounted by means of a pivot **46** for angularly moving to engage a seal **48** against a seal seat **50**. An X-brace valve latch **54** may be used to secure the valve element **44** in a latched position until the system is exposed to a predetermined temperature. When the system is exposed to a predetermined temperature, the fusible element will break engaging the sprinkler assembly **12** and initiating water flow.

In an embodiment, a flexible link **56** extends from the valve latch **54** to the sprinkler nozzle **16**. The flexible link **56** may be used in conjunction with or separate and apart from system **10** of FIG. **1**.

A first end of the flexible link **56** has a link pin for fitting into the valve latch **54**, as described herein, to secure the valve latch **54** in a latched position. A second end of the flexible link **56** has a plug adapter **60** for securing the flexible link **56** to the sprinkler plug **24**. An intermediate portion **62** of the flexible link **56** connects the plug adapter **60** to the link pin **58**, and centralizer braces **64** may be used to center the flexible link **56** within the flexible conduit **14**.

When the fusible element **22** breaks and engages the system, sprinkler plug **24** will release and allow downward movement of the flexible link **56**.

A bias member **66**, provided by a torsion spring, may be connected between the fitting **18** and the orifice **20** and the flexible link **56**. A coupler **68** secures the flexible link **56** to a run-out end of the bias member **66**. The bias member **66**

provides a motive force for moving the flexible link **56** downward to pull the link pin **58** from within the valve latch **54**.

A portion of the fitting **40** adjacent the valve latch **54** has an undercut **70**. The undercut **70** may be provided by a circumferentially extending groove, or by apertures formed radially into a first end of the fitting **40** to extend along a circumference of the fitting **40**, in an angularly spaced, diametrically opposed arrangement.

In an embodiment, system **12** may further comprise vent holes **98** in the fitting **18** and the elbow fitting **40**. Vent holes **98** may be employed to allow moisture to drain from within the system **12**.

In some embodiments, air, nitrogen, other inert gases, or a combination thereof may be sealed within the system **12** to prevent moisture from being retained within the system **12**, rather than employing the vent holes **98**.

The air, nitrogen, other inert gases, or a combination thereof introduced and sealed within the system may be pressurized. The pressurized inert gas may operate and function similarly to the pressurized inert gas described in system **10** of FIG. **1**. Additionally, in some embodiments, the pressurized inert gas and the flexible link **56** may act as a primary actuation and a secondary actuation for system **12**.

Air, nitrogen, other inert gases, or a combination thereof may be introduced into system **12** prior to installation or after installation.

System **12** may also include a diffuser **26**, or spray plate, and support arms **28**.

FIG. **4** is a sectional view of the flexible sprinkler assembly **12** of FIG. **3**, taken along the section line **2-2** of FIG. **3**, and shows a frontal elevation view of an X-brace type valve latch **54** in an unlatched position. FIG. **5** is a side elevation view of a slider lock **72** of FIG. **4**, and shows the lock pin **74** in a released position.

The valve latch **54** is shown having eight slider locks **72** arranged with respective longitudinal axes **86** in an angularly spaced alignment, with the longitudinal axes disposed at equally angular distances about a central point of a brace eye **94**. In alternative embodiments, the number of slider locks **72** may be increased or decreased as desired.

The brace eye **94** defines a centrally disposed section of the valve latch **54**, defined within a link pin guide **96** to which first ends of the brace arms **88** are fixedly secured.

The slider locks **72** each may have a brace arm **88** and lock pin **74**. In some embodiments, the brace arms **88** may be integrally formed as part of the valve element **44**.

The lock pins **74** have an elongate stem **80**, with a follower end **82** and a protuberant end **84**. In an embodiment, the follower end **82** and the protuberant end **84** are round. A fixed shoulder **78** is connected to the protuberant end **84** of the slider lock **72**. A bias member **76** is provided by a wound coil spring for extending between the fixed shoulder **78** and a stop **92** provided on the brace arm **88**, such that the lock pin **74** is urged to move away from the protuberant end **84** toward the follower end **82**.

The brace arms **88** may further include retainers **90** for slidably securing the lock pins **74** to the brace arms **88**. When the link pin **58** is not disposed within the brace eye **94**, the lock pins **74** are free to move towards follower ends **82** of respective ones of the slider locks **72** and the associated brace arms **88**, such that follower ends **82** protrude into the brace eye **94**.

FIG. **6** is a sectional view of the flexible sprinkler assembly **12** of FIG. **3**, taken along section line **2-2** of FIG. **3**, and shows a frontal elevation view of the X-brace valve latch **54** in a latched position. FIG. **7** is a side elevation view of a slider lock **72** of FIG. **6**, and shows the lock pin **74** in a locked position. FIG. **8** is an exploded view of a brace arm **88** and lock pin **74** of the X-brace latch **54** of FIG. **6**.

Referring to FIG. **6**, the flexible link **56** is shown in an initial position, as shown previously in FIG. **3**, with the link pin **58** engaged within the brace eye **94** of the valve latch **54**. In such a position, the link pin **58** pushes the lock pins **74** of the slider locks **72** radially outward from the brace eye **94**, which moves the protuberant ends **84** to radially extend into the undercut **70** and secure the valve element **44** in a closed position.

When the link pin **58** is released from within the brace eye **94**, the bias members **76** will urge the lock pins **74** to move from locked positions to the released positions, as shown in FIGS. **4-5**. The valve element **44** will open under the force of fluid pressure within the sprinkler branch **36**.

FIG. **9** is a side elevation view of an alternative lock pin **100**. The lock pin **100** has a bias member **102** provided by wound coil spring. The lock pin **100** may comprise an elongate stem **106**, a follower end **108** and a protuberant end **110**. In an embodiment, the follower end **108** and the protuberant end **110** may have rounded ends. A fixed shoulder **104** is provided spaced apart from the protuberant end **110**, for receiving the bias member **102** therebetween.

It may be advantageous to set forth definitions of certain words and phrases used in this patent document. The term "couple" and its derivatives refer to any direct or indirect communication between two or more elements, whether or not those elements are in physical contact with one another. The terms "include" and "comprise," as well as derivatives thereof, mean inclusion without limitation. The term "or" is inclusive, meaning and/or. The phrases "associated with" and "associated therewith," as well as derivatives thereof, may mean to include, be included within, interconnect with, contain, be contained within, connect to or with, couple to or with, be communicable with, cooperate with, interleave, juxtapose, be proximate to, be bound to or with, have, have a property of, or the like.

While this disclosure has described certain embodiments and generally associated methods, alterations and permutations of these embodiments and methods will be apparent to those skilled in the art. Accordingly, the above description of example embodiments does not define or constrain this disclosure. Other changes, substitutions, and alterations are also possible without departing from the spirit and scope of this disclosure, as defined by the following claims.

What is claimed is:

1. A flexible dry sprinkler head comprising:

a flexible conduit having a first end and a second end, the second end being configured to couple to a fluid supply;

a sprinkler nozzle mounted at the first end of the flexible conduit; and

a valve disposed proximate to the second end of the flexible conduit and having an open state and a closed state, the valve configured to allow fluid from the fluid supply to flow through the conduit when the valve is in the open state and to prevent fluid from the fluid supply from flowing through the conduit when the valve is in the closed state;

wherein the flexible conduit is configured to receive and contain pressurized gas, the pressurized gas maintaining the valve in the closed state.

2. The flexible dry sprinkler head of claim **1**, wherein the flexible dry sprinkler head is configured such that the pressurized gas is released through the sprinkler nozzle when the sprinkler nozzle opens, which in turn allows the valve to move from the closed state to the open state.

3. The flexible dry sprinkler head of claim 1, wherein the flexible conduit includes a corrugated hose.

4. The flexible dry sprinkler head of claim 3, wherein the flexible conduit includes an outer cover of braided metal.

5. The flexible dry sprinkler head of claim 1, wherein the flexible conduit is capable of being bent at a right angle.

6. The flexible dry sprinkler head of claim 1, wherein the valve is a check valve.

7. The flexible dry sprinkler head of claim 1, wherein the valve is a clapper valve.

8. The flexible dry sprinkler head of claim 1, wherein the sprinkler nozzle includes an element that breaks when exposed to predetermined temperatures.

9. A flexible dry sprinkler head comprising:

a flexible conduit having a first end and a second end, the second end being configured to be coupled to a fluid supply;

a sprinkler nozzle mounted at the first end of the flexible conduit, the sprinkler nozzle including an element that breaks when exposed to predetermined temperatures; and

a valve disposed proximate to the second end of the conduit and having an open state and a closed state, the valve configured to allow fluid from the fluid supply to flow through the conduit when the valve is in the open state and to prevent fluid from the fluid supply to flow through the conduit when the valve is in the closed state;

wherein the flexible dry sprinkler head is configured to receive and contain pressurized gas; and

wherein the sprinkler nozzle, the valve and the flexible conduit are configured such that breaking of the element releases the pressurized gas which in turn allows the valve to move from the closed state to the open state.

10. The flexible dry sprinkler head of claim 9, wherein the flexible conduit includes a corrugated hose.

11. The flexible dry sprinkler head of claim 10, wherein the flexible conduit includes an outer cover of braided metal.

12. The flexible dry sprinkler head of claim 9, wherein the flexible conduit is capable of being bent at a right angle.

13. The flexible dry sprinkler head of claim 9, wherein the conduit is filled with an inert gas under pressure between the first end and the valve.

14. The flexible dry sprinkler according to claim 9, further comprising a gas inlet for passing gas into the flexible conduit.

15. A flexible dry sprinkler head comprising:

a flexible conduit having a first end and a second end, the second end being configured to couple to a fluid supply;

a sprinkler nozzle mounted at the first end of the flexible conduit; and

a valve disposed proximate to the second end of the flexible conduit and having an open state and a closed state, the valve configured to allow fluid from the fluid supply to flow through the conduit when the valve is in the open state and to prevent fluid from the fluid supply from flowing through the conduit when the valve is in the closed state;

wherein the flexible conduit is filled with a liquid having antifreeze characteristics between the first end and the valve, the liquid maintaining the valve in the closed state.

16. The flexible dry sprinkler head of claim 15, wherein the flexible dry sprinkler head is configured such that the liquid passes through the sprinkler nozzle when the sprinkler nozzle opens, which in turn allows the valve to move from the closed state to the open state.

17. The flexible dry sprinkler head of claim 15, wherein the flexible conduit includes a corrugated hose and an outer cover of braided metal.

18. The flexible dry sprinkler head of claim 15, wherein the flexible conduit is capable of being bent at a right angle.

19. The flexible dry sprinkler head of claim 15, wherein the valve is a check valve.

20. A method of fire protection comprising the steps of:

providing a flexible dry sprinkler head comprising:

a flexible conduit having a first end and a second end, the second end being configured to couple to a fluid supply;

a sprinkler nozzle mounted at the first end of the flexible conduit; and

a valve disposed proximate to the second end of the flexible conduit and having an open state and a closed state, the valve configured to allow fluid from the fluid supply to flow through the conduit when the valve is in the open state and to prevent fluid from the fluid supply from flowing through the conduit when the valve is in the closed state; and

filling the flexible conduit with pressurized gas such that the pressurized gas maintains the valve in the closed state;

wherein the flexible dry sprinkler head is configured to release the pressurized gas when the sprinkler nozzle opens, which allows the valve to open and fluid from the fluid supply to pass through the conduit and out the sprinkler nozzle.

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